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ABSTRACT

The purpose of this study was to examine the computer-related experiences and anxiety of mathematics education majors across a ten-year period, the 1985-1986 through 1994-1995 academic years. This study centers on 10 years of data collection concerning mathematics education majors at West Virginia University in terms of their previous computer use, gender, and computer anxiety. It also examines the relationships between gender, previous computer experience, and computer anxiety along with the general patterns of computer experiences observed over the 10-year period. The participants in the study were 255 mathematics education majors enrolling in the West Virginia University education program. Data was taken from surveys filled out by the students as part of their enrollment in the education program. Findings from this study indicate that the more recent students have more computer experiences. Also, computer anxiety levels decreased during the study, and there were no significant differences between male and female students' anxiety levels. (Author)

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Computer-related experiences and Anxiety of Mathematics Education Majors (1985-1995)

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Abstract

The purpose of this study was to examine the computer-related experiences and anxiety of mathematics education majors across a ten-year period, the 1985-1986 through 1994-1995 academic years. This study centers on 10 years of data collection concerning mathematics education majors at West Virginia University in terms of their previous computer use, gender, and computer anxiety. It also examines the relationships between gender, previous computer experience, and computer anxiety along with the general patterns of computer experiences observed over the 10-year period.

The participants in the study were 255 mathematics education majors enrolling in the West Virginia University education program. Data was taken from surveys filled out by the students as part of their enrollment in the education program. Findings from this study indicate that the more recent students have more computer experiences. Also, computer anxiety levels decreased during the study, and there were no significant differences between male and female students' anxiety levels.

Literature Review

Computers have become a part of the daily routine of most students, whether in a lab or a classroom setting. Teachers, therefore, must have a level of competency in computer use and its role in the classroom. Unfortunately, as computers are being pushed into the classroom, some educators also have to deal with the issue of computer anxiety. A survey of 350 Australian teachers found that 30% admitted to suffering from some type of computer anxiety (Bradley and Russell, 1997). Even among students, education majors typically have a higher computer anxiety level than other majors, such

as computer science (Williams and Johnson, 1990). These types of findings may call in to question the effectiveness of teachers suffering from computer anxiety in using computers with their students.

Computer anxiety can be defined in psychological terms as a negative response to the use of information technology resources, particularly the personal computer (Williams and Johnson, 1990). It has also been defined as the fear or apprehension felt when using a computer, or when considering its use (Montag, Simonson, and Maurer, 1984). Maurer and Simonson (1984) stated that a person with computer anxiety would exhibit behaviors such as avoidance of computers, excessive caution when using computers, negative remarks toward computers, and attempts to cut short their use whenever possible. The three main sources of computer anxiety are concerns over damaging the computer's hardware or software, being unable to perform computer tasks efficiently, and a fear of exposing oneself to social embarrassment when working with computers (Bradley and Russell, 1997).

It is important to note how widespread the implementation of computers in the regular classroom has become, particularly in the elementary grades. A study of 1,206 regular education teachers completed by the Princeton Survey Research Associates (1993) found that two-thirds of elementary teachers had at least one computer in their classrooms. In the secondary grades, computers are just as pervasive, but are more likely to be centralized in laboratory settings rather than in the regular teacher's classroom, according to the study.

As stated earlier, education students have been found to have a higher level of computer anxiety than do fellow students in other fields (Williams and Johnson, 1990).

Even within the education field, students have been found to exhibit widely different levels of anxiety towards computers. Reed, Ervin, and Oughton (1995) studied education majors over a 10-year period, and found that elementary education majors had a significantly higher anxiety level than mathematics education majors, regardless of previous experience. The same study showed that English education majors did score a higher level of computer anxiety than elementary majors in some instances. However, another study (Liu and Reed, 1992) found that elementary education majors had the highest level of computer anxiety when compared to English education, physical education, special education, social studies education, science education and mathematics education majors.

Prior experience with computers seems to be an important factor related to computer anxiety. Nelson, Wiese, and Cooper (1991) found that students who drop out of computer classes tend to have little or no computer experience when compared to students who remain in a computer class. "Advocating learning programming as a means of fostering general self-efficacy with computers and affinity for computers is convergently indicated by the literature and the findings of this study" (Nelson, et al, 1991, p. 199). The researchers also stated that females who reported high levels of anxiety at the beginning of the computer class tended to drop the class while males who reported about the same amount of anxiety tended to complete the computer class. When examining this situation from an achievement motivation perspective, males who are confronted with a difficult situation tend to be persistent and overcome the obstacle, whereas females tend to be less persistent and withdraw.

While previous experience has been found to reduce computer anxiety, the type of experience and its quality also plays a significant factor. Sottile, Watson, and Iddings (1998) studied teachers' computer comfort and anxiety both before and after a five-day intensive computer training workshop, and found that anxiety was reduced, but not eliminated, by this type of training. Gos (1996) examined the relationship between computer anxiety and the quality of previous computer experience in a study of students taking a computerized Composition for English Teachers course. He concluded that computer anxiety does not necessarily disappear as computer experience increases, but that the type of experience a person has with the technology creates computer anxiety.

The use of computers in the classroom has focused some research into areas such as the relationship between gender and computer anxiety. Research in to the role gender plays in computer anxiety is, at best, mixed. Some studies indicate that males have a lower computer anxiety than females (Liu, Reed, et al, 1992), while others have indicated the opposite (Reed, Ervin, and Oughton, 1995). A study by Ayersman and Reed (1995) found that females outperformed males in a computer-programming course, in both the actual programming and written performance measures. Busch (1995) indicated in a study of 147 college students that, when controlling for previous computer experience and encouragement, there were no differences between gender in the areas of computer anxiety, computer confidence, and computer liking. The study did note a difference in self-efficacy for complex computer tasks, such as programming. This was attributed to males receiving more computer encouragement and support from peers and family (Busch, 1995).

Research Method

The purpose of this research was to determine the effects of gender, year-of-program-entry, and prior computer use on computer anxiety. The participants were 255 mathematics education majors who enrolled in the major program between the 1985-86 and 1994-1995 academic year. The Computer Anxiety instrument was a four-page instrument, delivered as part of a sign-up packet for admission to the Computer Awareness Module, which was an instructional unit given as an aid to passing a mandatory test needed for admission to the teacher education program. All education majors had the option of taking the survey, but this study focuses only on mathematics education majors.

The survey examined three independent and two dependent variables. Students reported their computer experiences, coded No Experience, CAI (Content-Area Software), CMI (general software tools, such as word-processing, spreadsheet, etc.), and Programming (knowledge of COBOL, BASIC, etc.) The students in the survey also listed gender and year-of-program entry, with each year consisting of the Fall, Spring, and first Summer session of that academic year. Year-of-Program-Entry was coded as Year 1 (1985-86), Year 2 (1986-87)...Year 10 (1994-95). The dependent measures included the Spielberger Self-Evaluation Questionnaire to measure computer anxiety given as part of the survey, and the patterns of prior computer experience, which were tabulated and converted to percentages for each of the ten years. The main research questions were, (1) What are the effects of year-of-program-entry, gender, and prior

computer experience on mathematics education majors' computer anxiety? and (2) What are the relative patterns of prior computer experience across the 10-year period?

Results

Both Year-of-Program-Entry ($F[9,204] = 4.187$, $p < .0001$) and Previous Computer Experience ($F[3,204] = 4.382$, $p < .0001$) had significant effects on Computer Anxiety. Surprisingly, gender was not found to have a significant effect on Computer Anxiety in this study ($F[1, 204] = 1.103$, $p < .313$). This may be due to the fact that research indicates the mathematics field is more focused on computer use than other content areas (Liu, Reed, et al, 1992). Regardless of gender, a student pursuing a degree in a mathematics field would expect to use computers frequently, therefore one may conclude that only those with low computer anxiety would consider such an endeavor.

Table 1 shows the relationship of Year-of-Program-Entry with Prior Experience. The levels of prior experience for the mathematics majors changed significantly over the course of the ten-year study. The number of students with no experience dropped dramatically in Years 1 through 4 (58.8% to 6.7%) before increasing in Years 5 and 6 (13.6% and 38.5% respectively). After Year 7, the number of students dropped to 14.3% by Year 10. Even with the upswing during the middle years, the percentage of mathematics majors without computer experience plummeted by 44.5%.

The increase in the number reporting CMI experience surpassed even the dramatic decrease in the number of students without computer experience. CMI experience increased from 0% in Year 1 to 15.3% in year 4, before dropping slightly over

the next two years. In years 7 through 10, a double-digit increase occurred each year, ending with 57.1% students having CMI experience in the final year.

Students entering the mathematics education major scored very low in their CAI experience. No patterns could easily be discerned over the course of the study, as their percentages went both up and down over time. A pattern of decline was noted in the Programming Experience after Year 4. Between Years 1 and 4 the percentage change went from 41.2% to 66.7%. After this peak, the percentages dropped to a low of 25% in Year 9 with only a minor variance between Years 7 and 8 (42.9% to 43.3%). The percentage did increase to 28.6% in the final year.

In Table 2, the comparison of Prior Experience and Year-of-Program-Entry is further subdivided by Gender. No discernible pattern of differences can be found in either the No Experience, CAI Experience, or Programming Experience between male and female. Interestingly, it appears that males were behind in gaining CMI experience. Females were found to have CMI experience by Year 3, while males did not register in this group until Year 5. Even more surprising was how quickly males gained CMI experience. While female experience in CMI rose from 11.8% to 42.9% between Years 5 and 10, males improved from 10% to 71.4% during the same period.

Table 3 shows the comparison of Gender, Previous Experience, and Computer Anxiety (standard deviations are in parentheses). Anxiety levels between males and females varied according to their experience level, with males with No Experience having a slightly higher level of anxiety than females. However, female anxiety was higher in CAI, CMI, and Programming. Overall, males registered a higher total anxiety level, which matched results of the study by Reed, Ervin, and Oughton (1995) using the

same general population, but examining the elementary education major subgroup. Unlike their study, Gender was not found to have a significant effect on anxiety. Though the males did have a higher anxiety score, the totals were very similar (40.62 for males, 40.07 for females). This result would appear to confirm some conclusions from Reed, Ervin, Oughton study. Namely, that gender is not a sole factor in determining computer anxiety.

The generally accepted pattern from previous research, that students with no experience will have a higher anxiety level than those with CAI experience, who will be higher than students with CMI experience, with Programming experience causing the least anxiety, did not hold true in this study. In both sexes, the anxiety level actually increased slightly between CAI and CMI experience (40.00 to 43.65 for males, 44.30 to 44.76 for females). This may be attributable to the low number of CAI experience students skewing the sample results (4 male, 10 female out of a sample population of 255). Combined, the anxiety level between CAI and CMI increased from 43.07 to 44.39. Majors with Programming experience did score the lowest anxiety level, as might be expected (31.08 total).

A surprising result of the survey, given other research from the same general population, was that Computer Anxiety did not decrease over the ten-year study. In fact, the overall anxiety reading went from 46.06 in Year 1 to 50.07 in the final year. For Years 1 through 4 the anxiety did decrease (46.06 to 31.73) but rose in Years 5 and 6. After falling in Year 7, the measured Computer Anxiety rating increased each year thereafter.

Discussion

With the major surge in computer technology sweeping through society, it is important that we examine how computer anxiety develops and its effect on students and classroom teachers. Gender does not appear to play nearly as critical a role as some have argued, but that a person's previous computer experience can reduce anxiety. One cannot conclude from this study that the overall anxiety levels of students towards computers is decreasing over time, as they are being exposed and learning more and more computer skills in their K-12 experiences. However, the shift from No experience, higher anxiety, to CMI experience and lower anxiety is a positive step in our efforts to reduce computer anxiety for everyone.

It was interesting to note the general downward turn of the number of students with Programming experience. From this data, it would appear that schools are moving away from the programming languages, such as COBOL and BASIC, to emphasize application software, such as word processing and spreadsheets. It would be interesting to research whether this trend has continued given the explosion of the Internet and its related languages and technologies.

This study indicates that concerns about gender-based anxiety concerning computers may be overblown, and that our educational emphasis should be on giving more experiences to all students. Only the previous computer experiences of students had a significant effect on their anxiety levels. This finding was across gender and year-of-program-entry. Gender-equity issues should focus mainly on equal access to the technology and information, and not on developing special methods to teach females.

Conclusions

As society becomes more and more computerized, people with computer anxiety will find fewer options for employment and growth. This is also true in teaching, where schools are pushing to place computers and Internet connections in every classroom and expecting teachers to integrate this technology into their everyday teaching. Students entering a teacher education program today may find their options very limited in terms of certification areas if they are not comfortable with computer technology.

This study found that contrary, to other research, gender is not a significant factor in computer anxiety. While this is heartening, the study does confirm that previous experience is a determining factor in computer anxiety. It would therefore be important to give students as much exposure to computers and computer applications as early and often as possible within the confines of a normal education. This does not mean taking time from other subject areas to teach computer skills, but instead integrating computers into the regular classroom. This would create a potential environment that encourages students to see the computer as another classroom resource, while giving them the valuable computer experience they need to reduce anxiety and prepare them for a place in society.

Based on this study, it appears that programming languages, such as BASIC, are slowly being removed from the regular curriculum and replaced with application software training, such as word processing. While the improvement in the number of students with CMI previous experience over the course of the study is laudable, the decline in programming skills is not. Not only does the programming experience reduce computer anxiety, but also provides real logic and technical skills that would help in

other subject areas. Particularly with the advent of the Internet, learning a language such as HTML would be beneficial to education majors wanting to use resources available on the Internet in their classrooms.

Finally, this study indicates that as mathematics education students increase their previous experience, the anxiety they feel towards the computer decreases. It is recommended that more computer education, both in terms of classroom integration and separate skill-type courses, be offered for K-12 and college students.

Table 1: Experience by Year-of-Entry

	None	CAI	CMI	Programming
Year 1	58.8% n=10	0.0% n=0	0.0% n=0	41.2% n=7
2	43.5% n=10	0.0% n=0	0.0% n=0	56.5% n=13
3	23.3% n=7	3.3% n=1	10.0% n=3	63.3% n=19
4	6.7% n=1	13.3% n=2	13.3% n=2	66.7% n=10
5	13.6% n=3	13.6% n=3	13.6% n=3	59.1% n=13
6	38.5% n=10	3.8% n=1	11.5% n=3	46.2% n=12
7	35.7% n=15	7.1% n=3	14.3% n=6	42.9% n=18
8	26.7% n=8	0.0% n=0	30.0% n=9	43.3% n=13
9	16.7% n=6	11.1% n=4	47.2% n=17	25.0% n=9
10	14.3% n=2	0.0% n=0	57.1% n=8	28.6% n=4
Totals	28.2% n=72	5.5% n=14	20.0% n=51	46.3% n=118

Table 2

Experience Type by Gender and Year-of-Entry

	None Male	None Female	CAI Male	CAI Female	CMI Male	CMI Female	Programming Male	Programming Female
Year 1	83.3% n=5	45.5% n=5	0.0% n=0	0.0% n=0	0.0% n=0	0.0% n=0	16.7% n=1	54.5% n=6
2	55.6% n=5	35.7% n=5	0.0% n=0	0.0% n=0	0.0% n=0	0.0% n=0	44.4% n=4	64.3% n=9
3	31.3% n=5	14.3% n=2	0.0% n=0	7.1% n=1	0.0% n=0	21.4% n=3	68.8% n=11	57.1% n=8
4	33.3% n=1	0.0% n=0	0.0% n=0	16.7% n=2	0.0% n=0	16.7% n=2	66.7% n=2	66.7% n=8
5	20.0% n=2	8.3% n=1	0.0% n=0	25.0% n=3	10.0% n=1	16.7% n=2	70.0% n=7	50.0% n=6
6	55.6% n=5	29.4% n=5	11.1% n=1	0.0% n=0	11.1% n=1	11.8% n=2	22.2% n=2	58.8% n=10
7	33.3% n=6	37.5% n=9	5.6% n=1	8.3% n=2	5.6% n=1	20.8% n=5	55.6% n=10	33.3% n=8
8	23.1% n=3	29.4% n=5	0.0% n=0	0.0% n=0	30.8% n=4	29.4% n=5	46.2% n=6	41.2% n=7
9	18.2% n=2	16.0% n=4	18.2% n=2	8.0% n=2	45.5% n=5	48.0% n=12	18.2% n=2	28.0% n=7
10	0.0% n=0	28.6% n=2	0.0% n=0	0.0% n=0	71.4% n=5	42.9% n=3	28.6% n=2	28.6% n=2

Table 3: Gender, Previous Experience and Computer Anxiety Levels

	No Exp.	CAI	CMI	Programming	Total
Male	53.15	40	43.65	30.51	40.62
	n=34	n=4	n=17	n=47	n=102
	(9.01)	(6.68)	(8.46)	(10.60)	(13.87)
Female	50.84	44.3	44.76	31.45	40.07
	n=38	n=10	n=34	n=71	n=153
	(10.23)	(16.03)	(10.96)	(11.59)	(14.09)
Totals	51.93	43.07	44.39	31.08	40.29
	n=72	n=14	n=51	n=118	n=255
	(9.67)	(13.86)	(10.12)	(11.17)	(13.97)

Table 4: Anxiety by Year-of-Entry

Year	Mean	Number (n)	Std. Deviation
1	46.09	n=17	18.27
2	39.26	n=23	17.96
3	31.97	n=30	13.90
4	31.73	n=15	12.03
5	35.05	n=22	13.99
6	43.00	n=26	11.56
7	40.93	n=42	11.97
8	42.27	n=30	10.50
9	43.75	n=36	11.47
10	50.07	n=14	12.22
Totals	40.29	n=255	13.97

References

Ayersman, D.J., and Reed, W.M. (1995). Effects of learning styles, programming, and gender on computer anxiety. Journal of Research on Computing in Education, 28 (2), 148-161.

Bradley, G., and Russell, G. (1997). Computer experience, school support and computer anxieties. Educational Psychology, 17 (3), 267-285.

Busch, T. (1995). Gender differences in self-efficacy and attitudes towards computers. Journal of Educational Computing research, 12 (2), 147-158.

Gos, M.W. (1996). Computer anxiety and computer experience: A new look at an old relationship. Clearing House, 69 (5), 271-276.

Liu, M. Reed, W.M., et al. (1992). Teacher education students and computers: Gender, major, prior computer experience, occurrence, and anxiety. Journal of Research on Computing in Education, 24 (4), 457-467.

Maurer, M. and Simonson, M. (1984). Development of validation of a measure of computer anxiety. In M. Simonson (Ed.), Proceeding of the Convention of the Association for Education Communications and Technology, 318-330 (ERIC Document Reproduction Service, Document ED 243.411).

Montag, M., Simonson, M.R., and Maurer, M.M. (1984). Test Administrator's Manual for the Standardized Test of Computer Literacy and Computer Anxiety Index. Iowa State University Research Foundation, Inc.

Nelson, L. J., Wiese, G. M., and Cooper, J. (1991). Getting started with computers: experience, anxiety, and relational style. Computers in Human Behavior, 7, 185-202.

Princeton Survey Research Associates (1993). National Education Association Communications Survey. Report of findings. (ERIC Document Reproduction Service No. ED360953).

Reed, W.M., Ervin, J.R., and Oughton, J.M. (1995). Computers and elementary education students: A ten-year analysis. Journal of Computing in Childhood Education, 6 (1), 5-24.

Sottile, J. M., Watson, G. R., and Iddings, W. J. (1998). The relationship of computer anxiety and computer competence among rural K-12 math and science teachers. Paper presented at the meeting of the Eastern Educational Research Association. Tampa, March.

Williams, C. and Johnson, A.B. (1990). A comparative study of computer anxiety between education and computer science students. Education, 110 (4), 481-485.